Institutional Births and Child Mortality: Evidence from the Janani Suraksha Yojana in India

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Abstract

The Janani Suraksha Yojana (JSY) is a conditional cash transfer program by the Government of India aimed at reducing maternal and child mortality by promoting facility-based deliveries. This study examines the impact of the JSY on facility birth and child mortality outcomes. Using a difference-in-differences approach, we compare outcomes between eligible and non-eligible women before and after the implementation of the JSY. Our findings indicate that the JSY significantly increased public facility deliveries and reduced infant and under-5 child mortality. Robustness checks confirm the validity of these results. We identify that the JSY improved child mortality outcomes through increased facility births and better access to antenatal and postnatal care. This study contributes to the debate on the efficacy of cash transfer programs by providing robust evidence that well-designed financial incentives can drive significant health improvements, especially in resource-constrained settings.

(*JEL* D13, I12, I15, J13, O12, O15)

Keywords: Child mortality, Institutional delivery, Health-seeking behavior, India

Statements and Declaration

Conflict of Interest.

The authors declare that they have no conflict of interest.

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1. Introduction

Child mortality remains a pressing global health challenge, with developing countries disproportionately affected. India, despite its high economic growth, continues to grapple with high rates of child deaths. A critical factor contributing to this issue is inadequate access to quality maternal and newborn care. Delivering in a health facility under the supervision of skilled professionals can substantially reduce the risk of complications during delivery and maternal and child deaths (Okeke & Chari, 2018; Campbell & Graham, 2006).

Recognizing the critical role of facility-based delivery in improving maternal and child health outcomes, the Government of India launched the Janani Suraksha Yojana (JSY) program. This national program aims to reduce both maternal and child mortality by promoting facility-based deliveries among vulnerable populations. The JSY operates as a conditional cash transfer (CCT) program, providing financial incentives to women who choose to deliver in public healthcare facilities. This study investigates the impact of the JSY on institutional births and child mortality outcomes.

Existing research on policies promoting institutional delivery paints a mixed picture. While financial incentives and abolishing user fees can increase institutional deliveries in some settings (e.g., Schmidt et al., 2010; Agha, 2011), their impact on child mortality varies across studies (Morris et al., 2004; De Brauw et al., 2011; Dzakpasu et al., 2012; Tura et al., 2013; Johnson et al., 2015; Friedman & Keats 2019). Similarly, previous evaluations of the JSY show significant increases in facility births but report negligible effects on child mortality outcomes (Powell-Jackson et al., 2015; Joshi & Sivaram, 2014; Gopalan & Varatharajan, 2012; Lim et al., 2010).

Current evaluations of the JSY face two key limitations. First, many existing studies adopt a descriptive approach, documenting program's effect in specific regions without establishing causal effects. Even the few studies that attempt causal estimation encounter issues of reverse causality due to their definition of the treatment variable. These studies define treatment exposure based on the proportion of women receiving the JSY benefits within a district. However, this approach introduces bias because women only receive the JSY benefits after delivering in a public facility. Consequently, the choice of delivery location becomes endogenous, influenced by the cash incentive itself.

Second, most studies use the JSY launch date of 2005 as the treatment start date. However, evidence suggests that the JSY's budget was not released until 2006, with full implementation

starting in 2007 (Das et al., 2011; Rahman & Pallikadavath, 2018).[1] By using an inaccurate treatment start date, existing studies risk conflating the treatment and control groups, potentially explaining the null effects observed in child mortality outcomes. This highlights the need for a more rigorous approach to assess the true causal effect of the JSY on child mortality in India.

We estimate the intent-to-treat effects of the JSY using a difference-in-differences (DiD) estimation approach. Eligibility for the JSY varies by state: women in low-performing states (institutional delivery rates below 25%) qualify for benefits by delivering in approved health facilities. In high-performing states (institutional delivery rates of 25% or more), women must meet additional requirements, such as being marginalized, aged 19 or older, and eligible only for the first two live births (Das et al., 2011; Rahman & Pallikadavath, 2018). This variation in eligibility criteria allows us to employ a difference-in-differences (DiD) research design to identify the causal effect of the JSY. We compare changes in outcomes between women who were eligible for the JSY benefits (treatment group) and those who were not (control group) before and after the program's implementation in 2007.

We find that the JSY significantly increased public facility deliveries by 9.9 percentage points, primarily by reducing home births. This suggests that financial constraints were a major barrier to institutional deliveries. Furthermore, the JSY led to a statistically significant reduction in infant and under-5 child mortality, with reductions of 5.2% and 4.9% respectively. These findings highlight the effectiveness of the JSY in improving child health outcomes.

To strengthen our findings, we conducted robustness checks to verify the parallel trend assumption, a crucial requirement for difference-in-differences estimation. The pre-trend test using the pre-JSY data (2000-2006) found no statistically significant differences in trends between the treatment and control groups before the program's implementation. Furthermore, the placebo test, where we re-estimated the model with artificial JSY implementation years in the pre-JSY period, yielded no significant treatment effects. These checks increase our confidence that the observed effects are likely due to the JSY and not driven by pre-existing trends.

We explore potential mechanisms for the JSY's impact on child mortality. Since the JSY increases facility births, it may also improve access to prenatal and postnatal care. Our findings

[1] Raw data trends presented in Figure 1 also support this argument. There is no discernable change in any outcome of interest prior to 2007.

indicate that the JSY significantly decreased home births and increased antenatal visits, postnatal check-ups within two weeks of birth, vitamin A intake, and vaccinations. These findings suggest that the JSY's positive impact on child mortality operates through a combination of increased facility births and improved access to essential healthcare services.

This study contributes to the growing body of literature on the efficacy of conditional cash transfer programs in improving health outcomes in developing countries (Owusu-Addo & Cross, 2014; Barham, 2011; Gertler, 2004). While existing research on programs like the JSY shows mixed results on child mortality reduction (e.g., Morris et al., 2004; Lim et al., 2010; De Brauw et al., 2011; Gopalan & Varatharajan, 2012; Johnson et al., 2015; Powell-Jackson et al., 2015), our study offers a unique perspective by employing a rigorous difference-in-differences (DiD) estimation approach. Our findings indicate that the JSY led to a statistically significant reduction in both infant and under-5 child mortality. Importantly, we address the issue of inaccurate treatment timing and endogenous treatment assignment found in prior evaluations, providing a more reliable estimate of the program's impact.

Our second contribution is identifying the mechanisms through which the JSY affects mortality. We demonstrate that the JSY not only increased facility births but also significantly improved access to prenatal and postnatal care. Specifically, we find that the JSY led to higher rates of pre-and postnatal visits, increased vitamin A intake, and higher vaccination rates. These results highlight that by reducing financial constraints and integrating individuals into the health system, the JSY promotes safer births and encourages continuous healthcare support for children. Therefore, this study demonstrates that well-designed financial incentives can drive significant health improvements, particularly in resource-constrained settings.

The rest of the paper is structured as follows. Section 2 provides the context of the study and describes the data and method. Section 3 presents the main estimation result, robustness check, heterogeneity analysis, and mechanisms of the effect. Section 4 concludes the paper.

2. Data and Method:

2.1 Janani Suraksha Yojana (JSY):

The Janani Suraksha Yojana (JSY) is a national maternal health program in India. It was launched in April 2005. The formal implementation of the JSY with an allocation of budget started in 2007 (Das et al., 2011; Rahman and Pallikadavath, 2018). The program aims to

reduce maternal and infant mortality by promoting institutional delivery.[2] Specifically, it provides cash assistance for women who give birth in a public health facility.[3] The implementation of the JSY heavily relies on accredited social health activists (ASHA), the community-based health workers employed by the federal government.[4]

The eligibility requirements for the JSY depend on the state of residence. Women living in a state with institutional delivery rates less than 25% (so-called low-performing states) qualify for the cash benefits once delivering at an approved health facility.[5] However, women who live in a state with an institutional delivery rate greater than or equal to 25% (so-called high-performing states) must meet additional requirements. The first requirement is being marginalized – women identified as scheduled caste or scheduled tribe, or the family is below the poverty line. The second requirement is for women to be 19 or older at the time of birth. Lastly, women are eligible to receive benefits for the first two live births only.

Based on the JSY eligibility requirements, we can identify treatment and control groups. The treatment group comprises all women from low-performing states and marginalized women from high-performing states who are aged 19 years and above with at most two live births. In contrast, the control group comprises women from high-performing states who are non-marginalized, aged below 19 at the time of birth, or aged 19 and above but have more than two live births.

2.2 Data:

Data for this study comes from two sources: the District Level Health Survey (DLHS) and the National Family Health Survey (NFHS). We utilize these surveys based on their respective strengths in data collection on different indicators. Specifically, data on places of child delivery comes from DLHS, while child mortality indicators are obtained from NFHS.

District Level Health Survey (DLHS). The District Level Health Survey (DLHS) is a repeated cross-sectional socioeconomic household survey with a special focus on reproductive and child

[2] The JSY also encourages women to receive prenatal and postnatal care.
[3] The amount of financial assistance varies with women's place of residence. Women living in the low-performing states (i.e., institutional delivery rates less than 25%) receive Rs. 1,400 in rural areas and Rs. 1,000 in urban areas, whereas women living in high-performing states (i.e., institutional delivery rates greater than or equal to 25%) receive Rs. 700 in rural areas and Rs. 600 in urban areas.
[4] ASHA serves as the point of contact for pregnant women and helps them with the JSY procedures, such as acquiring the necessary documents and making antenatal appointments.
[5] Ten states of India are in the low performing states (LPS) category: Uttar Pradesh, Uttaranchal, Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Assam, Rajasthan, Orissa, and Jammu and Kashmir. The rest of the states are in the high-performing states (HPS) category.

health. We use two waves of DLHS data that are nationally representative: DLHS-2 (2002-04) and DLHS-3 (2007-09). The primary respondents of both surveys are married women of reproductive age: 15-44 years in DLHS-2 and 15-49 years in DLHS-3. The DLHS provides information on the place of delivery of the woman's most recent birth. Based on the women's responses, we can identify whether the child was delivered in a public health facility, a private health facility, or at home.

Based on DHLS-2 and DHLS-3, we have data on places of birth from 2000 to 2008. Panel A of Figure 1 shows the trends in public facility delivery for the treated and control groups before and after the implementation of the JSY in 2007. It illustrates two separate linear trend lines for the treatment and control groups before and after the JSY. Both groups show a rising trend in public facility deliveries, but only the treatment group shows a substantial increase after the JSY.

National Family and Health Survey (NFHS). Indian National Family and Health Survey (NFHS) is a repeated cross-sectional socioeconomic household survey with a special focus on reproductive and child health. We use three waves of NFHS data: Wave-3 (2005-06) and wave-4 (2015-16), and Wave-5 (2019-22). The primary respondents of these surveys are ever-married women aged 15 to 49 years. NFHS provides the birth and death history of children even born to an eligible woman. Based on the mother's response of birth and death history, we created three indicators of child mortality: neonatal mortality (death within 30 days of birth), infant mortality (death within 12 months of birth), and under-5 child mortality (death within 5 years of birth).[6]

Based on the three waves of NFHS, we have data on child mortality indicators from 2000 to 2010. We restrict our sample to 2010 to avoid conflation with another national-level program Janani Shishu Suraksha Karyakaram (JSSK) implemented in year 2011 that made public facility delivery free for everyone. Panels B-D of Figure 1 show the trends in child mortality indicators for the treated and control groups before and after the implementation of the JSY in 2007. Panel B illustrates the trend in neonatal mortality, both treatment and control groups show a falling trend before and after the JSY. Panel C exhibits a declining trend in infant mortality for both groups before the JSY, whereas post-JSY, only the treatment group shows a lower infant mortality rate. Similarly, Panel D shows a falling trend in under-5 child mortality

[6] Although DLHS collects the mortality outcomes, we could not utilize that information as survey was conducted in 2007-08 making it impossible to generate post-JSY infant and child mortality outcomes.

for both groups before the JSY, with a substantial decline only for the treatment group post-JSY.

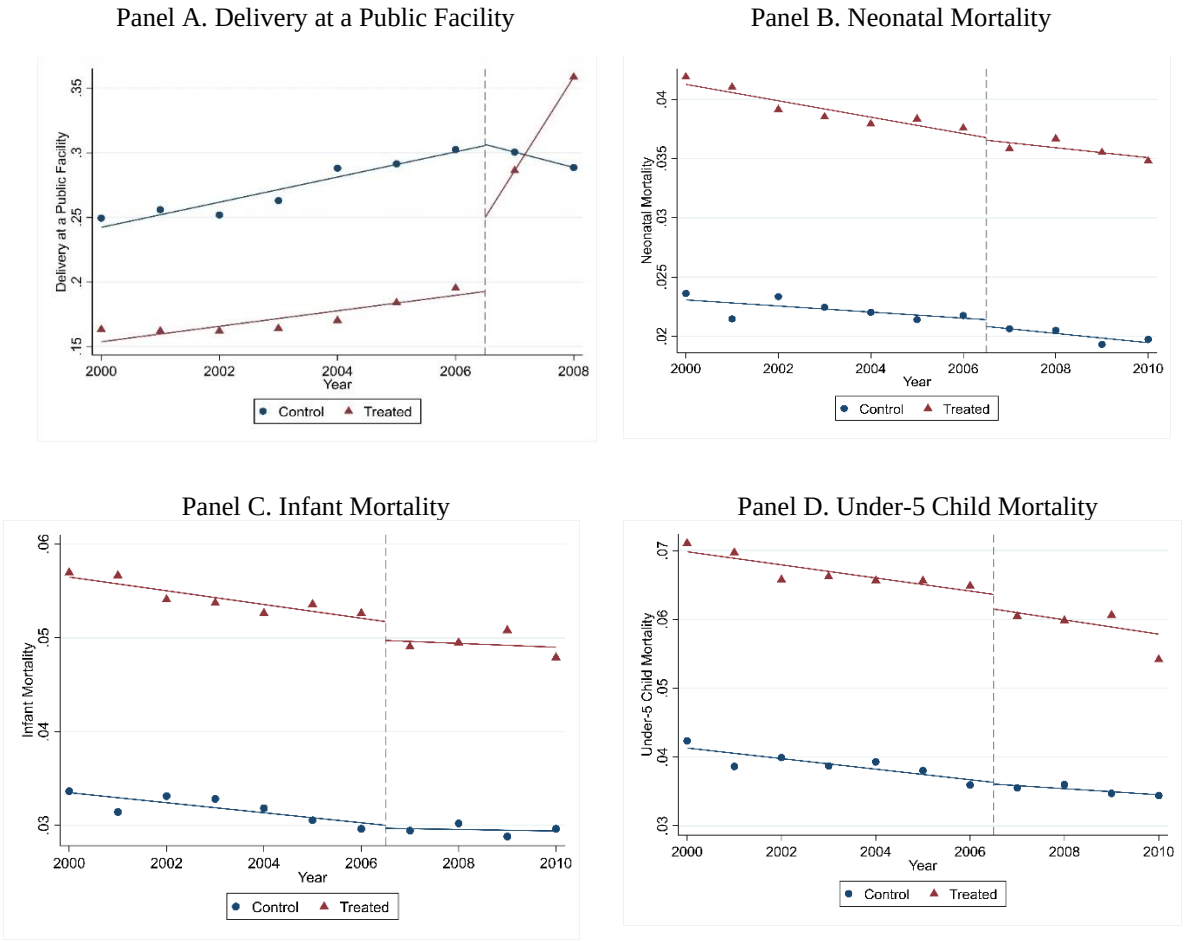


Figure 1: Trends in Outcome Variables

Table 1 provides summary statistics for critical variables in our estimation sample for the DHLS (columns 1-3) and NFHS (columns 4-6). For each survey, we provide statistics for the full sample, treated, and control groups. Household, mother, and child characteristics are pretty similar across the two surveys, except for birth order. Since DLHS collected place of birth data for the most recent birth, it has a larger share of first-born children compared to NFHS. Column 1 shows that home delivery is the most common place of childbirth (59%), followed by public facility delivery (23%). Columns 2 and 3 indicate that the treated group has a substantially higher rate of home delivery (66%) compared to the control group (43%). On the contrary, the control group has a higher rate of public facility delivery (28%) than the treatment group (20%).[7]

[7] Public facility delivery for the treatment group pre-JSY was 17% and post-JSY was 30%, whereas private facility delivery remained constant at around 14% both pre-and post-JSY.

Table 1: Summary Statistics

	All	Treated	Control	All	Treated	Control
	(1)	(2)	(3)	(4)	(5)	(6)
Controls						
Urban (=1 if yes)	0.23	0.18	0.30	0.24	0.21	0.31
	(0.42)	(0.39)	(0.46)	(0.43)	(0.40)	(0.46)
Hindu (=1 if yes)	0.75	0.81	0.66	0.76	0.81	0.67
	(0.43)	(0.39)	(0.47)	(0.43)	(0.39)	(0.47)
Wealth quintile 1 (=1 if yes)	-	-	-	0.27	0.34	0.13
	-	-	-	(0.44)	(0.47)	(0.33)
Mother literate (=1 if yes)	0.53	0.42	0.71	0.55	0.47	0.71
	(0.50)	(0.49)	(0.45)	(0.50)	(0.50)	(0.45)
Marginalized (=1 if yes)	0.19	0.22	0.13	0.20	0.21	0.18
	(0.39)	(0.42)	(0.34)	(0.40)	(0.40)	(0.39)
Mother's age at birth, at least 19 (=1 if yes)	0.73	0.73	0.74	0.66	0.66	0.67
	(0.44)	(0.44)	(0.44)	(0.47)	(0.47)	(0.47)
Girl child (=1 if yes)	0.47	0.47	0.46	0.48	0.48	0.48
	(0.50)	(0.50)	(0.47)	(0.50)	(0.50)	(0.50)
First-born child (=1 if yes)	0.67	0.67	0.66	0.33	0.31	0.37
	(0.47)	(0.47)	(0.47)	(0.47)	(0.46)	(0.48)
Second-born child (=1 if yes)	0.13	0.11	0.15	0.29	0.27	0.31
	(0.33)	(0.32)	(0.36)	(0.45)	(0.45)	(0.46)
	394,608	245,642	148,966	1,786,957	1,184,966	601,991
Outcomes						
Delivery at a public facility (=1 if yes)	0.23	0.18	0.30	-	-	-
	(0.42)	(0.39)	(0.46)	-	-	-
	[394,608]	[245,642]	[148,966]			
Neonatal death, within 30 days (=1 if yes)	-	-	-	0.03	0.04	0.02
	-	-	-	(0.18)	(0.19)	(0.14)
	-	-	-	[1,073,359]	[1,144,031]	[588,328]
Infant death, within 12 months (=1 if yes)	-	-	-	0.05	0.05	0.03
	-	-	-	(0.21)	(0.22)	(0.17)
	-	-	-	[1,745,403]	[1,156,131]	[589,272]
Child death, within 5 years (=1 if yes)	-	-	-	0.06	0.06	0.04
	-	-	-	(0.23)	(0.25)	(0.19)
	-	-	-	[1,617,143]	[1,075,439]	[541,704]
Data source	DLHS	DLHS	DLHS	NFHS	NFHS	NFHS

Notes: (a) This table shows the summary statistics such as sample size, mean and standard deviation. (b) Columns (1)-(3) show statistics for the full sample, treated, and control groups based on the District Level Health Survey (DLHS). Columns (4)-(6) show statistics based on the National Family and Health Survey (NFHS). (c) The number of observations varies for

different mortality outcomes because they include only children who have reached their respective ages. In those cases, the number of observations are presented in parentheses.

Column 4 shows that the overall neonatal mortality rate is 3% (30 children per 1,000 births). Columns 5 and 6 indicate that the treatment group has almost twice the neonatal mortality rate of the control group (2%). Similarly, the treatment group has substantially higher infant (5%) and under-5 child mortality (7%) rates compared to the control group, which has rates of 3% and 4%, respectively.[8]

2.3 Method:

The implementation of the JSY in 2007 across all states of India provides an opportunity for a before-after comparison. However, the program used different eligibility criteria in different states. While all women from low-performing states were eligible, several selection criteria such as marginalized household status, mother's age, and number of live births were used in high-performing states. This variation in the JSY eligibility criteria provides the second source of variation for a canonical difference-in-differences (DiD) estimation.

The treatment group comprises all women from low-performing states and marginalized women (i.e., below the poverty line or scheduled caste or scheduled tribe) aged at least 19 with at most two live births from high-performing states. In contrast, the control group comprises women from high-performing states who are non-marginalized, aged below 19, or have more than two live births. By comparing changes in child mortality outcomes between the treatment and control groups over time, this study identifies the causal effect of the JSY.

We estimate the intent-to-treat effects of the JSY using a difference-in-differences (DiD) estimation approach. The estimation equation is as follows:

$$Y_{ist} = \beta_0 + \beta_1 Treat_{ist} + \beta_2 Post_t^{JSY} + \beta_3 Post_t^{JSY} \times Treat_{ist} + \beta_4 X_{ist} + \alpha_t + \gamma_s + \epsilon_{ist} \quad (1)$$

Here, Y_{ist} is the indicator for woman i's place of child delivery in state s and in year t. $Treat_{ist}$ is an indicator variable that takes the value of one if a woman belongs to the treatment group, and zero otherwise. $Post_t^{JSY}$ is also an indicator variable that equals 1 if the year of childbirth is greater than or equal to 2007, and zero otherwise. The interaction term $Post_t^{JSY} \times Treat_{ist}$ is the treatment indicator, which equals one if JSY-eligible women gave birth after the JSY

[8] Pre-JSY, neonatal mortality for the treatment group was 3.97%, declining to 3.5% post-JSY. Similarly, infant and child mortality rates for the treatment group were 5.5% and 6.8%, which declined to 4.8% and 5.8%, respectively.

implementation in 2007, and zero otherwise. β_3 captures the effect of the JSY on women's place of delivery. α_t and γ_s capture the year and state fixed effects, respectively. X_{ist} is a vector of controls, including religion, urban residence, marginalized status, mother's age, mother's literacy, child's sex, and child's birth order. The error term ϵ accounts for the unobserved factors.

We use the same estimation equation to estimate the effect of the JSY on child mortality outcomes. Specifically, we re-estimate equation (1) where Y_{ist} captures different child mortality outcomes for child i who was born in year t in state s. In the case of neonatal mortality, Y_{ist} indicates whether the child i died within a month of birth. Similarly, for infant and under-5 child mortality outcomes, Y_{ist} indicates whether the child died within 12 months and 5 years of birth, respectively.

The identifying assumption of Eq (1) for β_3 to capture the causal effect of the JSY is the parallel trend: the treatment group would have had a similar trend as the control group in the absence of the JSY. Since the parallel trend is an untestable assumption, we examine whether the treated and control groups already had similar trends before the JSY implementation. Figure 1 shows that the treated group has similar trends as the control group for both place of delivery and mortality outcomes before the JSY implementation. This finding provides suggestive evidence that the parallel trend is unlikely to be violated. We also conducted a formal statistical test to determine whether the trends were different before the JSY implementation. We estimate the following regression model only on the pre-JSY sample (2000-2006):

$$Y_{ist} = \alpha_g + \gamma_1 Year + \gamma_2 Year \times Treated_{ist} + \epsilon_{ist} \qquad (2)$$

Here, α_g is the group (i.e., treated and control) fixed effect and $Year$ captures the linear time trend. The interaction term $Year \times Treated$ allows the time trend to be different for treated and control groups. γ_2 measures whether the trends were different leading up to the treatment period. A zero coefficient (i.e., $\gamma_2 = 0$) would suggest that the trends were unlikely to be different.[9]

Additionally, we conducted a placebo test to lend further credibility to our DiD estimation. We used data before the JSY and assigned a fake JSY implementation year. If re-estimating Eq (1) with the pre-JSY data and a fake treatment date produces a null treatment effect, it provides

[9] See Section "3.2 Robustness Checks" for the results of the robustness checks.

further evidence that the parallel trend assumption is likely to hold. We implemented this placebo test twice, with the JSY implementation years of 2005 and 2006.

3. Results:

3.1 Main Results:

This section presents the main estimation results based on Eq (1). The underlying argument is that JSY's cash transfers encourage public facility births by reducing the relative cost of public facility delivery. A child delivered at a public facility would encounter fewer health complexities, leading to a reduction in child mortality. Table 2 shows the estimates of the JSY program on public facility delivery and child mortality outcomes. Odd columns present the estimation results without covariates, while even columns present results with covariates. All estimations control for the state, year of birth, and survey year fixed effects. Standard errors are clustered at the state level.

Column (1) of Table 2 shows that the JSY has a significant positive effect on public facility delivery. The point estimate is robust to the inclusion of additional controls, as evidenced by the almost identical coefficient in column (2). Specifically, the JSY led to a 9.9 percentage point increase in the likelihood of public facility birth. This effect is statistically significant at the 1% level. This increase in public facility births due to the JSY translates to a 66% rise from the pre-JSY average of 0.15.

This rise in public facility births primarily resulted from a substantial reduction in home deliveries (about two-thirds of the treatment effect) and a smaller reduction in private facility deliveries (about one-third of the treatment effect), as shown in Appendix Table A1. The stronger reduction in home deliveries compared to private facility deliveries indicates that financial constraints are a significant barrier to accessing institutional delivery.[10] This finding underscores the importance of financial support in enhancing access to institutional deliveries.

[10] While the JSY also included efforts to provide information and encourage facility deliveries, the differential impact on home versus private facility deliveries suggests that financial constraints were the more binding constraint. This finding is consistent with the evidence presented in Appendix Table A2, which highlights the stronger financial constraints on health-seeking behavior. The positive coefficients for wealth quintiles across various health-seeking behaviors (such as public facility use, antenatal and postnatal visits, taking iron tablets, receiving tetanus shots, vitamin A intake, and total vaccination received) underscore the significant role of financial constraints, with higher wealth consistently increasing the likelihood of health seeking. In contrast, the interaction terms between wealth quintiles and urban (a proxy for better access to information) show that information constraints have a relatively weaker influence in determining health-seeking behavior.

We next turn to the mortality results. Columns (3)-(4) show the impact on neonatal mortality (death within 30 days), columns (5)-(6) on infant mortality (death within 12 months), and column (7)-(8) on under-5 child mortality (death within 5 years). The result in column (4) shows no significant effect of the JSY on neonatal mortality. This result is consistent with previous studies (Friedman and Keats 2019; Tura et al., 2013) and correlational evidence before the JSY (see Appendix Table A3).[11] Tura et al. (2013), in their systemic review, found that approximately 50% of the studies reported no significant effect of institutional births on neonatal mortality. Furthermore, among the studies that did find significant effects, the effect sizes were generally small.

Table 2: Effect of the JSY

	Delivery		Mortality					
	Public Facility (=1 if yes)		Neonatal Mortality (=1 if yes)		Infant Mortality (=1 if yes)		Child Mortality (=1 if yes)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat x After JSY	0.098***	0.099***	-0.001	-0.001	-0.0027*	-0.0028*	-0.0032**	-0.0033**
	(0.035)	(0.035)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	394,608	394,608	1,732,359	1,732,359	1,745,403	1,745,403	1,617,143	1,617,143
Controls	No	Yes	No	Yes	No	Yes	No	Yes
State FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of Birth FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Data Source	DLHS	DLHS	NFHS	NFHS	NFHS	NFHS	NFHS	NFHS

Notes: (a) Controls include religion, urban, household wealth, marginalized household, mother's age, mother literate, child's sex, and child's birth order. (b) Standard error clustered at the state level. (c) The number of observations varies for different mortality outcomes because they include only children who have reached the respective ages. (d) *** p<0.01, ** p<0.05, * p<0.1.

Columns (5)-(6) show that the estimated effect of the JSY on infant mortality is 0.003 (with and without controls), which is statistically significant at the 10% level. This result suggests that the JSY decreased infant mortality by 0.003 percentage points, which is a 5.2% reduction from the pre-JSY average of 0.054 (54 infant deaths per 1,000 live births). Columns (7)-(8) show the impact of the JSY on a relatively longer-term outcome, under-5 child mortality. Column (8) shows that the JSY led to a 0.003 percentage point reduction in under-5 child mortality, which is statistically significant at the 5% level. This is a reduction of 4.9% from the pre-JSY average of 0.067 (67 child deaths per 1,000 live births). Therefore, this result indicates that the JSY saved about 3 children per 1,000 live births.

[11] Appendix Table A3 explores the correlation between health-seeking and mortality prior to JSY. The results show that neonatal morality is not strongly correlated with public facility births.

3.2 Robustness Checks

In this section, we present the results of the robustness checks. We conducted two robustness checks: a pre-trend test and a placebo treatment test. The pre-trend test is pivotal to validate the parallel trend assumption of the DiD estimation, which posits that, in the absence of the JSY, both treated and control groups would have followed parallel trajectories. We conducted the pre-trend test using a pre-JSY sample (2000-2006) and estimation Eq (2). The coefficient on interaction term Year×Treated captures whether trends were different leading up to the treatment period.

Table 3 presents the results of the pre-trend test for public facility births and mortality outcomes. The coefficients of the interaction term Year×Treated across all outcomes are close to zero and statistically insignificant at the 5% level. This result indicates that we are unable to reject the hypothesis of equal pre-trends between treated and control groups. Therefore, it is unlikely that the parallel trend assumption will be violated.

Table 3: Pre-trend Test

	Delivery	Mortality		
	Public Facility (=1 if yes)	Neonatal Mortality (=1 if yes)	Infant Mortality (=1 if yes)	Child Mortality (=1 if yes)
	(1)	(2)	(3)	(4)
Treat x Year	-0.007	-0.0004*	-0.0002	-0.0002
	(0.005)	(0.0002)	(0.0003)	(0.0003)
Year	0.006*	-0.0002	-0.0004**	-0.0007***
	(0.003)	(0.0001)	(0.0002)	(0.0002)
Observations	302,776	1,109,858	1,114,925	1,086,505
Controls	No	No	No	No
Survey Year FEs	Yes	Yes	Yes	Yes
Data Source	DLHS	NFHS	NFHS	NFHS

Notes: (a) Standard error clustered at the state level. (b) Only pre-treatment samples are used in this analysis. (c) The number of observations varies for different mortality outcomes because they include only children who have reached the respective ages. (d) *** p<0.01, ** p<0.05, * p<0.1.

Moving forward, we present the result of the placebo test, a critical exercise aimed at validating the robustness of our estimation approach. In this test, we re-estimated Eq (1) using the pre-JSY data from 2000 to 2006, while assigning artificial JSY implementation years. We conducted this placebo test twice, assigning fake JSY implementation years of 2005 and 2006. The test should yield null treatment effects as only pre-treatment period data is used. A null effect would suggest that the parallel trend assumption is unlikely to be violated, further reinforcing the reliability of our estimation results.

Table 4 presents the results of the placebo test for both public facility delivery and mortality outcomes. In Panel A, where the placebo treatment year is set to the year 2005, the coefficients are consistently close to zero and statistically insignificant across all outcomes. Notably, this finding remains robust to the inclusion of covariates. Similarly, in Panel B, with the placebo treatment year set to the year 2006, the coefficients are close to zero and statistically insignificant. These results indicate the absence of a discernable treatment effect associated with the placebo JSY implementation years. Consequently, this finding strengthens the notion that the parallel trend assumption likely holds in this context, thereby bolstering the credibility of our DiD estimation results.

Table 4: Placebo Effect of the JSY

	Delivery		Mortality					
	Public Facility (=1 if yes)		Neonatal Mortality (=1 if yes)		Infant Mortality (=1 if yes)		Child Mortality (=1 if yes)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Post 2005								
Treat x After JSY	-0.013	-0.012	-0.001	-0.001	0.001	0.001	0.001	0.001
	(0.020)	(0.020)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Panel B: Post 2006								
Treat x After JSY	-0.007	-0.008	-0.002	-0.002	0.001	0.001	0.001	0.001
	(0.020)	(0.020)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	302,776	302,776	1,109,858	1,109,858	1,114,925	1,114,925	1,086,505	1,086,505
Controls	No	Yes	No	Yes	No	Yes	No	Yes
State FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of Birth FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Data Source	DLHS	DLHS	NFHS	NFHS	NFHS	NFHS	NFHS	NFHS

Notes: (a) Controls include religion, urban, household wealth, marginalized household, mother's age, mother literate, child's sex, and child's birth order. (b) Standard error clustered at the state level. (c) Only pre-treatment samples are used in this analysis. (d) The number of observations varies for different mortality outcomes because they include only children who have reached the respective ages. (e) *** p<0.01, ** p<0.05, * p<0.1.

3.3 Heterogeneity

In this section, we explore the heterogeneity of the treatment effect of the JSY by key child and mother characteristics. Specifically, we analyze whether the JSY has differential effects based on the child's gender, birth order, and the mother's literacy status. Table 5 presents the results of these analyses. Columns (1)-(2) of Panel A show the coefficients on the interaction of the JSY and gender, capturing the differential effect of the JSY by gender. The result shows no significant difference in public facility delivery for boys and girls. However, columns (3)-(4) indicate that the JSY led to lower neonatal mortality for girls. Although Table 2 shows no

overall effect of the JSY on neonatal mortality, this finding suggests that the JSY might have a slightly stronger protective effect against neonatal mortality for girls. The effects on infant and child mortality do not show significant gender-specific differences, implying a relatively uniform impact of the JSY across genders for these outcomes.

Table 5: Heterogenous Effect of the JSY

	Delivery		Mortality					
	Public Facility (=1 if yes)		Neonatal Mortality (=1 if yes)		Infant Mortality (=1 if yes)		Child Mortality (=1 if yes)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Gender								
Treat x After JSY x Girl	-0.001	-0.002	-0.0015*	-0.0015*	-0.001	-0.001	-0.001	-0.001
	(0.004)	(0.005)	(0.0008)	(0.0008)	(0.001)	(0.001)	(0.001)	(0.001)
Treat x After JSY	0.098**	0.100**	-0.001	-0.001	-0.002	-0.002	-0.003**	-0.001
	(0.037)	(0.037)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Panel B: Birth Order								
Treat x After JSY x First Born	-0.065***	-0.044***	-0.001	0.001	-0.002	-0.003	-0.002	0.001
	(0.015)	(0.015)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Treat x After JSY	0.160***	0.143***	-0.001	-0.002	-0.002	-0.001	-0.003*	-0.003**
	(0.035)	(0.034)	(0.001)	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)
Panel C: Mother's Literacy								
Treat x After JSY x Literate	0.008	0.023	0.001	0.001	0.001	0.001	0.001	0.001
	(0.015)	(0.015)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Treat x After JSY	0.095**	0.089**	-0.002	-0.002	-0.003	-0.003*	-0.003*	-0.004**
	(0.037)	(0.036)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Observations	394,608	394,608	1,732,359	1,732,359	1,745,403	1,745,403	1,617,143	1,617,143
Controls	No	Yes	No	Yes	No	Yes	No	Yes
State FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of Birth FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Data Source	DLHS	DLHS	NFHS	NFHS	NFHS	NFHS	NFHS	NFHS

Notes: (a) Controls include religion, urban, household wealth, marginalized household, mother's age, mother literate, child's sex, and child's birth order. (b) Standard error clustered at the state level. (c) The number of observations varies for different mortality outcomes because they include only children who have reached the respective ages. (d) *** p<0.01, ** p<0.05, * p<0.1.

Panel B shows significant differences in public facility delivery based on birth order. The likelihood of public facility delivery is significantly lower for first-born children, suggesting that the JSY is less effective for first-time mothers in promoting deliveries in public facilities. However, there is no evidence of differential mortality based on the child's birth order. Panel

C shows no evidence of a differential effect of the JSY by the mother's literacy status, suggesting that the JSY is equally accessible to women regardless of their literacy status.[12]

3.4 Mechanism:

Although we have established a robust treatment effect of the JSY on mortality outcomes, understanding the precise mechanisms through which the JSY affects mortality requires further exploration. By promoting facility births, the JSY may also enhance access to other critical health services, including prenatal and postnatal care. Consequently, we delve into these potential mechanisms by focusing on the intake of prenatal and postnatal inputs. We examine four indicators of prenatal care during pregnancy: antenatal visits, iron supplementation, tetanus immunization, and home-based deliveries. Additionally, we assess postnatal care through indicators such as postnatal check-ups within two weeks of birth, vitamin A intake, and total vaccinations received.[13]

Table 6 presents the estimated effects of the JSY on the uptake of prenatal and postnatal inputs. The coefficients represent the likelihood of taking each input. We observe that the JSY significantly increased antenatal visits (0.08 percentage points) and decreased home-based deliveries (0.07 percentage points). However, we find no significant effect on the uptake of iron supplementation and tetanus shots.

Table 6: Effect Mechanism

	Prenatal Inputs				Postnatal Inputs		
	Antenatal Visit (=1 if yes)	Took Iron Tablet (=1 if yes)	Took Tetanus Shot (=1 if yes)	Home Birth (=1 if yes)	Postnatal Visit (=1 if yes)	Child Received Vitamin A (=1 if yes)	Total Vaccination
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treat x After JSY	0.080**	0.026	-0.009	-0.066**	0.047***	0.088***	0.383***
	(0.031)	(0.041)	(0.015)	(0.030)	(0.016)	(0.028)	(0.124)
Observations	394,463	335,807	394,468	394,608	206,033	379,548	385,074
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of Birth FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Survey Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Data Source	DLHS	DLHS	DLHS	DLHS	DLHS	DLHS	DLHS

Notes: (a) Controls include religion, urban, marginalized household, mother's age, mother literate, child's sex, and child's birth order. Standard error clustered at the state level. (b) Postnatal Visit within two weeks is available only for the DLHS round 3. (c) Total vaccination includes six vaccinations (two polio doses, DPT, BCG, measles, and hepatitis B) that we observe in DLHS 2 and DLHS 3. (d) Standard error clustered at the state level. (e) *** p<0.01, ** p<0.05, * p<0.1.

[12] Although not presented in Table 5, we also find no significant difference in mortality outcomes between households residing in urban and rural areas.

[13] Postnatal checks within two weeks of birth are available only for the DLHS round 3, spanning the years 2004 to 2008. Total vaccination received Total vaccination includes six vaccinations (two polio doses, DPT, BCG, measles, and hepatitis B) that we observe in DLHS 2 and DLHS 3.

We find a significant positive effect of the JSY on postnatal check-ups within two weeks of birth, with an increase of about 5 percentage points, representing an 11% rise from the pre-treatment rate of 43%. The JSY also increased the likelihood of receiving vitamin A by 0.09 percentage points, a 39% increase from the pre-treatment rate of 23%. Similarly, we find that the JSY increased the total number of vaccinations received by an average of 0.38, a 16% increase from the pre-treatment average of 2.41 vaccinations. These findings underscore the JSY's potential to not only promote facility births but also improve access to essential prenatal and postnatal healthcare services, thus potentially contributing to reduced child mortality rates.

4. Conclusion:

This study examines the impact of India's Janani Suraksha Yojana (JSY) – a conditional cash transfer program – on institutional births and child mortality. Using a difference-in-differences approach, we provide robust evidence that the JSY significantly increased public facility deliveries, primarily by alleviating financial barriers. Additionally, the JSY led to statistically significant reductions in infant and under-5 child mortality rates. These results underscore the effectiveness of the JSY in improving child health outcomes by promoting institutional deliveries and enhancing access to essential antenatal and postnatal care services.

The findings of this study have several important implications. First, they demonstrate that cash transfer programs like the JSY can effectively improve health outcomes in developing countries. By reducing financial constraints, such programs can increase the utilization of essential health services, leading to better child health. Second, the study highlights the crucial role of facility-based deliveries in reducing child mortality. Enhanced access to antenatal and postnatal care facilitated by the JSY promotes safer births and fosters continuous healthcare support for mothers and children.

Our research contributes to the growing body of literature on the efficacy of conditional cash transfer programs in improving health outcomes. This study demonstrates that well-designed financial incentives can drive significant health improvements, especially in resource-constrained settings. By showcasing the positive impact of the JSY, our study offers valuable insights for policymakers in India and other developing countries seeking to reduce child mortality.

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Appendix:

Table A1: Spillover Effect of the JSY on the Place of Delivery

	Private Facility (=1 if yes)		At Home (=1 if yes)	
	(1)	(2)	(3)	(4)
Treat x After JSY	-0.032**	-0.033**	-0.066**	-0.066**
	(0.014)	(0.013)	(0.030)	(0.030)
Observations	394,608	394,608	394,608	394,608
Controls	No	Yes	No	Yes
State FEs	Yes	Yes	Yes	Yes
Year of Birth FEs	Yes	Yes	Yes	Yes
Survey Year FEs	Yes	Yes	Yes	Yes
Data Source	DLHS	DLHS	DLHS	DLHS

Notes: (a) Controls include religion, urban, marginalized household, mother's age, mother literate, child's sex, and child's birth order. Standard error clustered at the state level. (b) Standard error clustered at the state level. (c) *** p<0.01, ** p<0.05, * p<0.1.

Table A2: Correlation Between Household Wealth and Urbanicity with Health Seeking (Prior to the JSY)

	Public Facility (=1 if yes)	Antenatal Visit (=1 if yes)	Postnatal Visit (=1 if yes)	Took Iron Tablet (=1 if yes)	Received Tetanus Shot (=1 if yes)	Child Received Vitamin A (=1 if yes)	Total Vaccination
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Poorer x Urban	0.048	0.031	0.005	0.056**	-0.028	0.002	-0.097
	(0.030)	(0.027)	(0.019)	(0.025)	(0.046)	(0.019)	(0.165)
Middle x Urban	0.060*	0.020	-0.011	0.037	-0.042	0.013	-0.297
	(0.033)	(0.034)	(0.018)	(0.035)	(0.042)	(0.016)	(0.194)
Richer x Urban	0.064	-0.001	-0.007	0.024	-0.046	0.022	-0.123
	(0.039)	(0.034)	(0.020)	(0.024)	(0.043)	(0.019)	(0.174)
Richest x Urban	-0.043	0.001	-0.013	0.074***	-0.058	0.032	0.299
	(0.039)	(0.037)	(0.031)	(0.023)	(0.043)	(0.021)	(0.214)
Urban (=1 if yes)	0.067*	0.006	0.007	-0.058**	0.048	-0.041**	-0.118
	(0.018)	(0.031)	(0.014)	(0.028)	(0.042)	(0.016)	(0.196)
Poorer (=1 if yes)	0.037**	0.096***	0.003	0.070***	0.095***	0.021**	0.634***
	(0.018)	(0.012)	(0.006)	(0.013)	(0.014)	(0.010)	(0.081)
Middle (=1 if yes)	0.094***	0.186***	0.024**	0.160***	0.191***	0.058***	1.44***
	(0.028)	(0.018)	(0.010)	(0.020)	(0.020)	(0.013)	(0.135)
Richer (=1 if yes)	0.141***	0.278***	0.046***	0.250***	0.263***	0.074***	2.05***
	(0.031)	(0.023)	(0.012)	(0.022)	(0.027)	(0.012)	(0.122)
Richest (=1 if yes)	0.147***	0.332***	0.080***	0.335***	0.317***	0.103***	2.59***
	(0.041)	(0.028)	(0.021)	(0.026)	(0.032)	(0.016)	(0.156)
Observations	48,786	36,731	16,243	36,541	36,731	38,760	48,495
Controls	No	No	No	No	No	No	No
State FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of Birth FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Data Source	NFHS	NFHS	NFHS	NFHS	NFHS	NFHS	NFHS

Notes: (a) Higher wealth indicates lower financial constraint, whereas living in urban areas indicates greater access to information. The interaction terms between urban and wealth quintiles indicate the effect of being in an urban area (proxy for better access to information) on health-seeking behavior within each wealth quintile. (b) Standard error clustered at the state level. (c) *** p<0.01, ** p<0.05, * p<0.1.

Table A3: Correlation Between Health-seeking and Mortality (Prior to the JSY)

	Neonatal Mortality (=1 if yes)	Infant Mortality (=1 if yes)
	(1)	(2)
Public Facility Birth (=1 if yes)	-0.002	-0.007***
	(0.002)	(0.002)
Antenatal Visit (=1 if yes)	-0.011***	-0.010**
	(0.002)	(0.004)
Postnatal Visit (=1 if yes)	-0.019***	-0.015***
	(0.002)	(0.003)
Mother Took Iron Tablet (=1 if yes)	-0.009***	-0.015***
	(0.002)	(0.003)
Mother Received Tetanus Shot (=1 if yes)	-0.018***	-0.013***
	(0.003)	(0.003)
Observations	47,630	38,048
Controls	No	No
State FEs	Yes	Yes
Year of Birth FEs	Yes	Yes
Data Source	NFHS	NFHS

Notes: (a) Each cell in this table comes from a different regression estimation. (b) Standard error clustered at the state level. (c) The number of observations varies for different mortality outcomes because they include only children who have reached the respective ages. Only 2005 rounds of NFHS is used in this analysis. Under-5 child mortality outcome cannot be obtained because of data unavailability. (d) *** p<0.01, ** p<0.05, * p<0.1.